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MECHANISM OF ADAPTATION TO A THREONINE-DEFICIENT DIET, PART IV

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(b) MECHANISM OF ADAPTATION TO A THREONINE-DEFICIENT DIET,

IV. Effect of age and weight on threonine deficiency symptoms in the rat,

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When weanling rats are fed a threonine-deficient diet, fat deposits in the livers reach a maximum in approximately 2 weeks. This phase is followed by a period of recovery wherein the concentration of fat is slowly decreased.

The mechanisms controlling these responses have not been established. It is necessary to attempt to define the nature of the biochemical responses to a threonine deficiency.

This study was designed to measure whether or not the age and weight of the rat at the time of feeding the low protein, threonine-deficient diet exerted any influence on the severity of the resulting fatty liver syndrome.

EXPERIMENTAL

Eighty male weanling rats of the Sprague-Dawley strain were used in this experiment. The animals were divided into two major dietary groups. Rats in Group I were fed a 9% casein diet supplemented with 0.36% DL-threonine, while rats in Group II were fed the identical diet except that no threonine was added. The per cent composition of these diets has been presented in previous reports. In this experiment, however, an additional variable was introduced: a "pre-experimental" phase wherein the animals were fed Rockland pellets for varying periods of time. See Table I for clarification of the experimental design. Groups I_o and II_o served as control groups in this study of the effect of the age of the animal on the severity of the fatty liver syndrome. Food and water were allowed ad libitum.

After each group of rats had been fed the casein diet for a period of 2 weeks, the animals were stunned with a sharp blow on the head and decapitated. Livers were removed from the carcass, weighed, and homogenized. The homogenates were dried and ground, and samples weighing approximately 1 g were continuously extracted with ether for 3 hours.

Blood samples were taken from representative rats in each group. Electrophoretic patterns were run from serum prepared from each sample of whole blood.

RESULTS

Liver fat data are presented in Table II.

Livers from all rats fed casein diets deficient in threonine ~~(group III)~~ had significantly greater concentrations of fat than did the control animals. These differences were significant at the 1% level ~~(P = 0.01)~~ regardless of the length of the "pre-experimental" feeding trial" ~~(Table II)~~. However, the absolute amount of fat deposited in livers from rats fed a threonine-deficient diet decreased as the length of the pellet-feeding phase increased. The same trend, though on a much smaller scale, was observed in the control rats ~~(group I)~~.

DISCUSSION

A quantity of liver fat significantly greater than in control animals was induced by feeding a threonine-deficient diet for 2 weeks to rats 21, 28, 35 and 42 days old. However, the amount of fat deposited varied directly with the age of the animal.

Since this experiment was designed as a pilot study, the data are insufficient to support the suggestion that the liver fat curve described in a threonine-deficiency state is a function of age of the animal. Since the animals did not develop fatty livers to the same extent in all threonine-deficient groups, the age of the rat must play an important role in the development of this syndrome. But since complete data on the rate of fat deposition within a dietary treatment are not available for each group, it is not possible to assay the effect of a low protein, threonine-deficient diet on older animals. It is possible that in an older animal the peak in liver fat deposition induced by a threonine deficiency may occur more or less rapidly than in a younger rat.

A more extensive experiment is now in progress to attempt to explore these facets. The experimental groups defined in this paper have been used. However, each group will be studied separately through a long-term period (6 weeks). Rats will be studied with respect to liver fat deposition, growth, activity of serum transaminase, and concentration of serum proteins.

TABLE I

Experimental Design

Group *	Days on Pellets	Days on 9% Casein Diet	Threonine Supplement
I_o	0	14	+
II_o	0	14	--
I_1	7	14	+
II_1	7	14	--
I_2	14	14	+
II_2	14	14	--
I_3	21	14	+
II_3	21	14	--

* Each group was composed of 10 weanling rats.

TABLE II

Liver Fat Data for Rats Fed a Pellet Ration and 9% Casein With and Without Threonine Supplement

Weeks fed Pellets	% Dry Wt. Group I (0.36% DL-Threonine)	Group II (No Threonine Supp.)
0	11.2± 0.6 *	21.0 ± 1.4 *
1	10.4± 0.5	18.4 ±1.0
2	8.2± 0.6	15.4 ±1.0
3	7.5± 0.3	10.6 ± 0.5

* Standard error of mean.